AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning on line 6 of p. 1 with the following replacement paragraph:

This application is a continuation-in-part of ~~U.S. Appl. Ser. No. 10/384,994~~ U.S. Pat. No. 6,967,344, filed on March 10, 2003 and entitled "Multi-Terminal Chalcogenide Switching Devices", the disclosure of which is hereby incorporated by reference herein; a continuation-in-part of ~~U.S. Appl. Ser. No. 10/426,321~~ U.S. Pat. No. 6,969,867, filed on April 30, 2003 and entitled "Field Effect Chalcogenide Devices", the disclosure of which is hereby incorporated by reference herein; and a continuation-in-part of U.S. Appl. Ser. No. 10/657,285 filed on September 8, 2003 and entitled "Multiple Bit Chalcogenide Storage Device", the disclosure of which is hereby incorporated by reference herein.

Please replace the paragraph beginning on line 18 of p. 3 with the following replacement paragraph:

The instant inventors have recently proposed the use of chalcogenide phase change materials as an active material for the processing and storage of data. In ~~U.S. Pat. Appl. Ser. No. 10/144,319 (the '319 application)~~ U.S. Pat. No. 6,671,710 (the '710 patent), the disclosure of which is hereby incorporated by reference herein, Ovshinsky et al. describe a principle of operation of phase change materials in computing applications. Phase change materials can not only operate in the binary mode characteristic of conventional silicon computers, but also offer

opportunities for the non-binary storage and processing of data. Non-binary storage provides for high information storage densities, while non-binary processing provides for increased parallelness of operation. The ~~'319~~ '710 patent also describes representative algorithms that utilize a non-binary computing medium for mathematical operations such as addition, subtraction, multiplication and division. ~~U.S. Pat. Appl. Ser. No. 10/155,527 (the '527 application)~~ U.S. Pat. No. 6,714,954 (the '954 patent) by Ovshinsky et al., the disclosure of which is hereby incorporated by reference herein, describes further mathematical operations based on a phase change computing medium, including factoring, modular arithmetic and parallel operation.

Please replace the paragraph beginning on line 8 of p. 4 with the following replacement paragraph:

In ~~U.S. Pat. Appl. Ser. No. 10/189,749 (the '749 application)~~ U.S. Pat. No. 6,999,953 (the '953 patent), the disclosure of which is hereby incorporated by reference herein, Ovshinsky considers the architecture of computing systems based on devices utilizing a phase change material as the active computing medium. More specifically, Ovshinsky considers networks of phase change computing devices and demonstrates functionality that closely parallels that of biological neural networks. Important features of this functionality include the accumulative response of phase change computing devices to input signals from a variety of sources, an ability to weight the input signals and a stable, reproducible material transformation that mimics the firing of a biological neuron. This functionality enables a new concept in intelligent computing that features learning, adaptability, and plasticity.

Please replace the paragraph beginning on line 18 of p. 4 with the following replacement paragraph:

~~In U.S. Pat. Appl. Ser. Nos. 10/384,994 (the '994 application)~~ U.S. Pat. Nos. 6,967,344 (the '344 patent) and 6,969,867 (the '867 patent); ~~10/426,321 (the '321 application);~~ and U.S. Pat. Appl. Ser. No. 10/657,285 (the '285 application), the disclosures of which are hereby incorporated by reference herein, Ovshinsky et al. further develop the notion of phase change computing by discussing additional computing and storage devices. The ~~'994 application~~ '344 patent discusses a multi-terminal phase change device where a control signal provided at one electrical terminal modulates the current, threshold voltage or signal transmitted between other electrical terminals through the injection of charge carriers. The ~~'321 application~~ '867 patent describes a related multi-terminal device that utilizes a field effect terminal to modulate the current, threshold voltage or signal transmitted between other terminals. The devices described in the ~~'994 and '321 applications~~ '344 and '867 patents may be configured to provide a functionality analogous to that of the transistor that is so vital to silicon based computers. The '285 application presents a multiple bit storage device having multiple terminals that utilizes a phase change material.

Please replace the paragraph beginning on line 5 of p. 8 with the following replacement paragraph:

In a preferred embodiment, chalcogenide materials are used as the phase change material in the instant invention. Chalcogenide materials have been previously utilized in optical and

electrical memory and switching applications and some representative compositions and properties have been discussed in in U.S. Pat. Nos. 5,543,737; 5,694,146; 5,757,446; 5,166,758; 5,296,716; 5,534,711; 5,536,947; 5,596,522; and 6.087,674; the disclosures of which are hereby incorporated by reference herein, as well as in several journal articles including "Reversible Electrical Switching Phenomena in Disordered Structures", Physical Review Letters, vol. 21, p.1450 – 1453 (~~1969~~ 1968) by S.R. Ovshinsky; "Amorphous Semiconductors for Switching, Memory, and Imaging Applications", IEEE Transactions on Electron Devices, vol. ED-20, p. 91 – 105 (1973) by S.R. Ovshinsky and H. Fritzsche; the disclosures of which are hereby incorporated by reference herein. General characteristics and comments about phase change chalcogenide materials are reviewed in the context of the instant invention in the following discussion.

Please replace the paragraph beginning on line 14 of p. 12 with the following replacement paragraph:

The resistance plot includes two characteristic response regimes of a chalcogenide material to electrical energy. The regimes are approximately demarcated with the vertical dashed line **10** shown in Fig. 1. The regime to the left of the line **10** may be referred to as the accumulating regime of the chalcogenide material. The accumulation regime is distinguished by a nearly constant or gradually varying electrical resistance with increasing electrical energy that culminates in an abrupt decrease in resistance beyond a threshold energy. The accumulation regime thus extends, in the direction of increasing energy, from the leftmost point **20** of the resistance plot, through a plateau region (generally depicted by **30**) corresponding to the range of

points over which the resistance variation is small or gradual to the set point or state **40** that follows an abrupt decrease in electrical resistance. The plateau **30** may be horizontal or gradually sloping. The left side of the resistance plot is referred to as the accumulating regime because the structural state of the chalcogenide material continuously evolves as energy is applied with the fractional crystallinity of the structural state correlating with the total accumulation of energy. The leftmost point **20** corresponds to the structural state in the accumulating regime having the lowest fractional crystallinity. This state may be fully amorphous or may contain some initial crystalline content. As energy is added, the fractional crystallinity increases and the chalcogenide material transforms in the direction of increasing energy among a plurality of partially crystalline states along the plateau **30**. Selected accumulation states (structural states in the accumulation region) are marked with squares in Fig. 1. Upon accumulation of a threshold amount of energy, the fractional crystallinity of the chalcogenide material increases sufficiently to effect a setting transformation characterized by a dramatic decrease in electrical resistance and stabilization of the set state **40**. The structural states in the accumulation regime may be referred to as accumulation states of the chalcogenide material. Structural transformations in the accumulating regime are unidirectional in the sense that they progress in the direction of increasing energy within the plateau region **30** and are reversible only by first driving the chalcogenide material through the set point **40** and resetting as described in, for example, ~~the '527 and '749 applications~~ '954 and '953 patents.

Please replace the paragraph beginning on line 18 of p. 13 with the following replacement paragraph:

While not wishing to be bound by theory, the instant inventors believe that the addition of energy to a chalcogenide material in the accumulating regime leads to an increase in fractional crystallinity through the nucleation of new crystalline domains, growth of existing crystalline domains or a combination thereof. It is believed that the electrical resistance varies only gradually along the plateau **30** despite the increase in fractional crystallinity because the crystalline domains form or grow in relative isolation of each other so as to prevent the formation of a contiguous crystalline network that spans the chalcogenide material. This type of crystallization may be referred to as sub-percolation crystallization. The setting transformation coincides with a percolation threshold in which a contiguous, interconnected crystalline network forms within the chalcogenide material. Such a network may form, for example, when crystalline domains increase sufficiently in size to impinge or overlap with neighboring domains. Since the crystalline phase of chalcogenide materials is more conductive and less resistive than the amorphous phase, the percolation threshold corresponds to the formation of a contiguous low resistance conductive pathway through the chalcogenide material. As a result, the percolation threshold is marked by a dramatic decrease in the resistance of the chalcogenide material. The leftmost point of the accumulation regime may be an amorphous state or a partially crystalline state lacking a contiguous crystalline network. Sub-percolation crystallization commences with an initial amorphous or partially crystalline state and progresses through a plurality of partially crystalline state having increasingly higher fractional crystallinities until the percolation threshold and setting transformation occur. Further discussion of the behavior of chalcogenide materials in the accumulation regime is provided in the ~~'319, '527, and '749 applications~~ '710, '954, and '953 patents and in U.S. Pat. Nos. 5,912,839 and 6,141,241; the disclosures of which are hereby incorporated by reference herein.

Please replace the paragraph beginning on line 8 of p. 17 with the following replacement paragraph:

A schematic depiction of the central portion of a three-terminal device according to the instant invention is shown in Fig. 3. The device three includes a pore ~~205~~ 205 filled with a chalcogenide material **210** that is in contact with a top electrical terminal **240**, a bottom electrical terminal **250** and an intermediate electrical terminal **260**. An insulating or dielectric material or materials **270** separates the electrical terminals **240**, **250** and **260**. The pore may be cylindrical or non-cylindrical in shape. If the pore **205** is cylindrical, the intermediate terminal **260** is preferably annular in shape. If the pore **205** is non-cylindrical, the intermediate terminal **260** is preferably circumferential in shape.

Please replace the paragraph beginning on line 19 of p. 40 with the following replacement paragraph:

A summary of the operating characteristics of this embodiment of the instant logic device is presented in the table below. Input 1 is the input signal applied between terminals **715** and **750**, input 2 is the input signal applied between terminals **735** and **750**, and the output is the measured resistance between **735** and ~~**750**~~ 715 after application of the two input signals. The inputs are listed as crystallizing or amorphizing pulses, where the pulse amplitude and durations are comparable to those described in EXAMPLES 1 – 4 hereinabove.